The environmental context of predation losses in the South Delta

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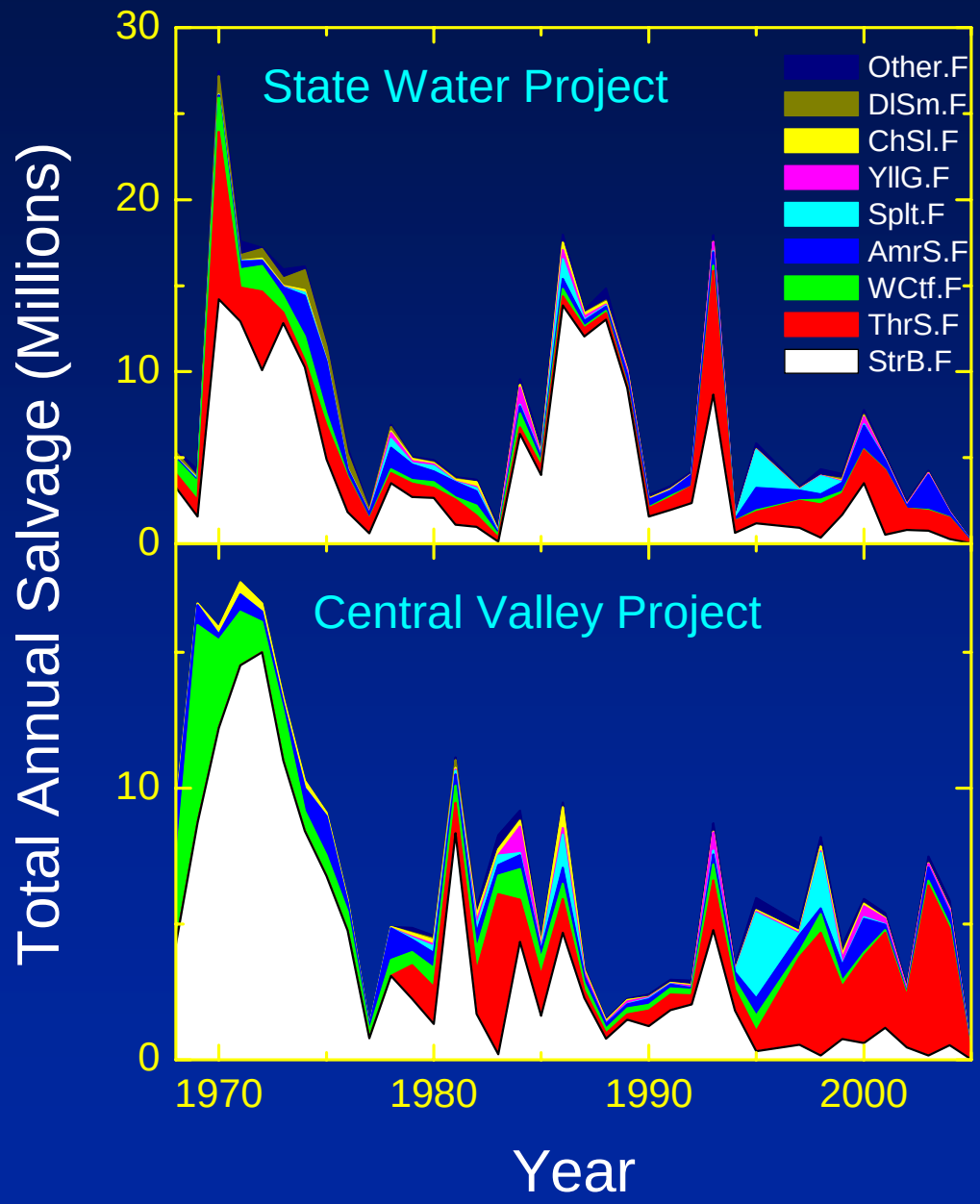
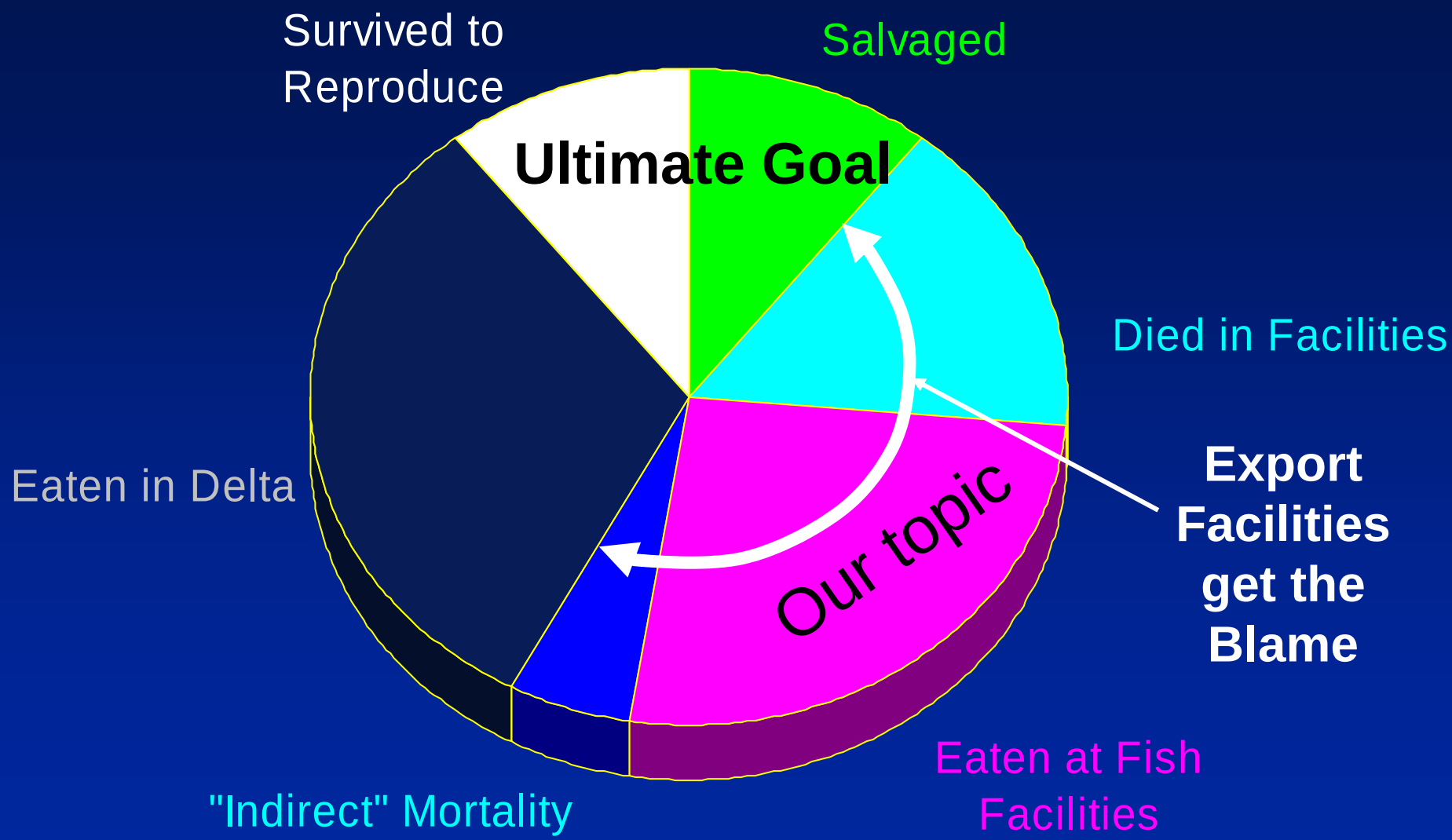
Summary

- Look at the big picture
- What are the components of losses to the export facilities?
- How does predation figure into these calculations?
- What can we say about their magnitude using existing data?
- What do particle tracking models tell us?

Species composition of salvage



Hypothetical Export Effects on Populations



Calculations of Export Effects on Populations

Objective of Measurement	Metric	Issues
Magnitude of Salvage	Salvage at Fish Facilities / Population Size	Apples and Oranges
Predator Losses (or Louver / Net Efficiency	Abundance per unit volume at fish facilities / Same in net samples	Different Efficiencies
Magnitude of Loss	Abundance per volume in South Delta * Export flow / Population Size	Assumes all are lost
Effect of Export Activities	Slope of Abundance or Survival vs. Export Flow (X2 effect?)	Power may be low
Predator Losses (or Louver Efficiency)	Comparison of lengths of salvaged fish between the two facilities	Interpretation, source populations
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Abundance of Striped Bass from Field Surveys and Fish Facilities

Values are geometric means (confidence limits) of ratios of monthly catch per volume in salvage to catch per volume in surveys.

Survey Data	CWP Fish Facility	SWP Fish Facility
Summer Townet	0.47 (0.34 to 0.65)	1.2 (0.9 to 1.7)
Fall Midwater Trawl	1.3 (1.0 to 1.8)	1.3 (0.8 to 2.2)

IEP Data through 1996: 85 df for TNS, 70 for MWT

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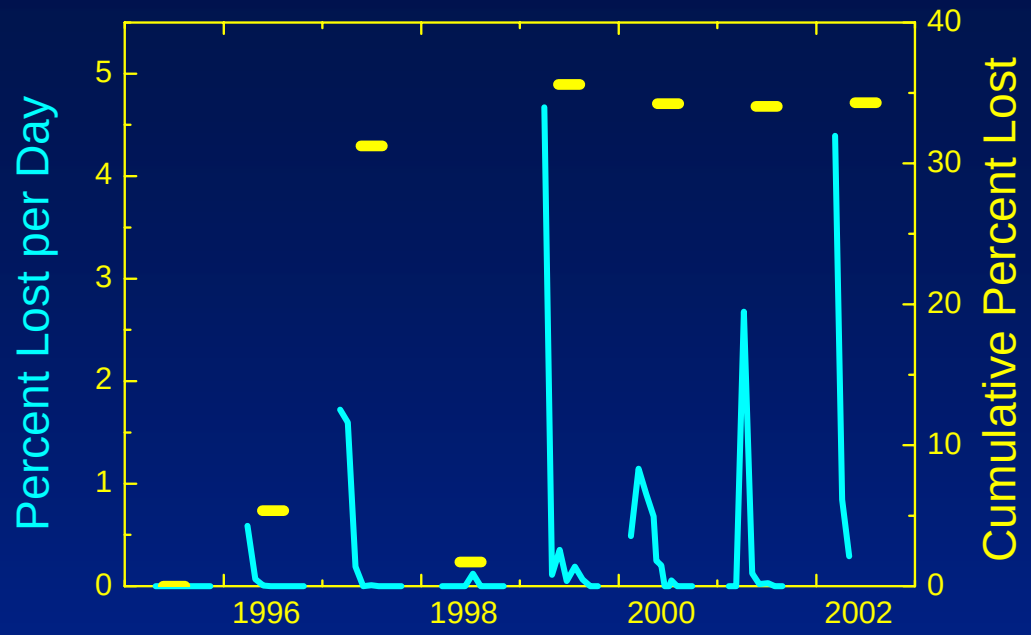
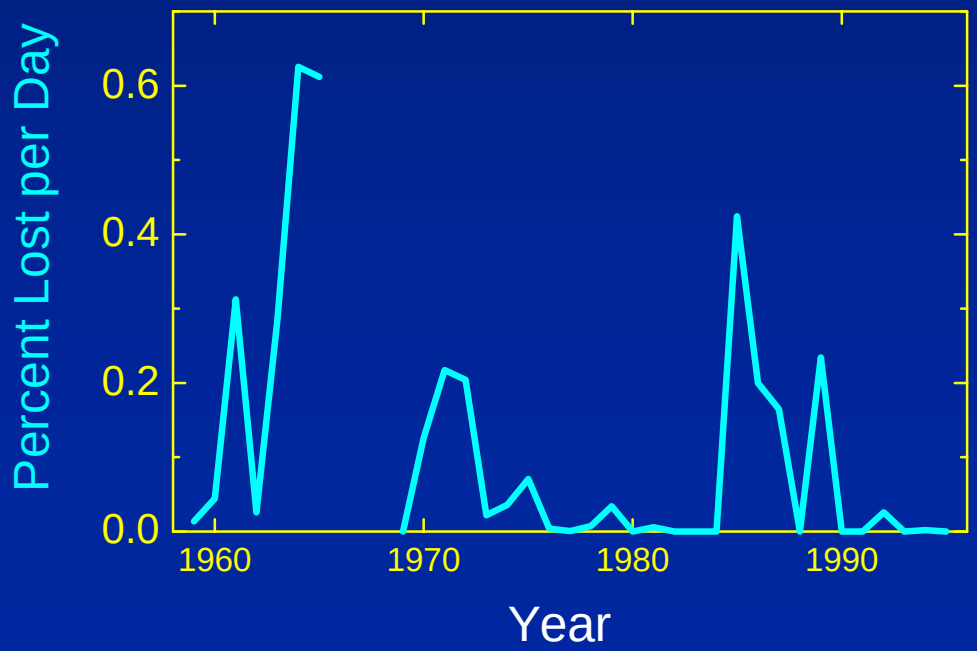
Export Losses of Delta Smelt



Spring 20mm Survey

Fish per volume in south Delta * Export flow / Total population size



Summer Townet Survey

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Survival of Striped Bass vs. X2 and export flow

Life Stage	Model	df	Slope	R^2
Egg to YOY (Summer)	X2 residual export flow *	22	-0.03 ± 0.01 -0.004 ± 0.003	0.59
Egg to YOY (Summer)	X2 only (less 1994)	21	-0.03 ± 0.01	0.59
Egg to 6mm larvae	X2 only	12	-0.03 ± 0.01	0.67
6mm larvae to YOY	Export Flow (May – June)	12	-0.003 ± 0.004	--

* Residual from nonlinear relationship with X2
Kimmerer et al. 2001 Estuaries

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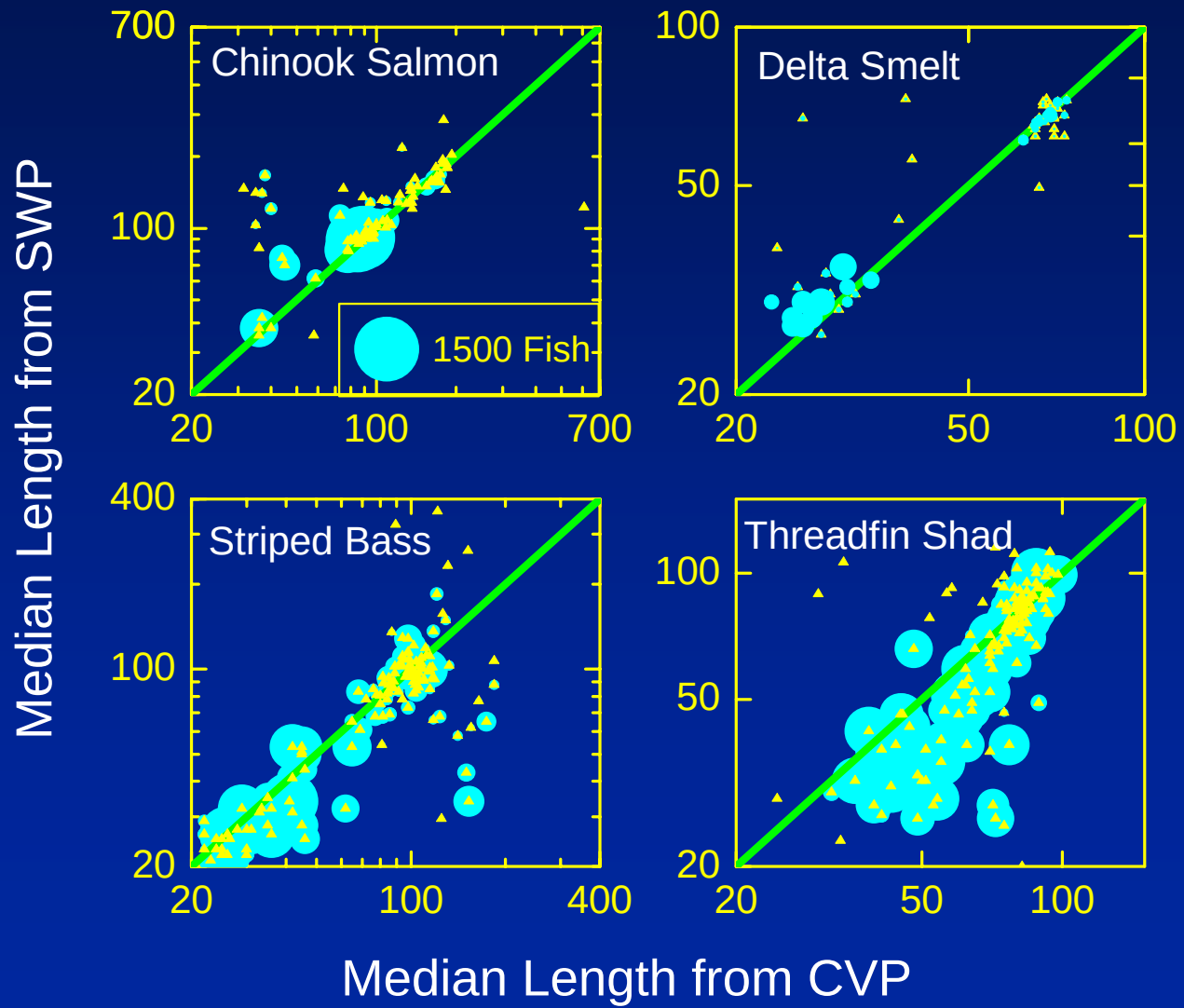
Lengths of Common Fish from the Fish Facilities

How do you expect the length data to compare?

- Higher predation in front of SWP
  - Smaller fish eaten?
  - Larger fish eaten?
- Louver efficiencies vary differently by size?
  - Smaller fish get through CVP screens?

Lengths of Common Fish from the Fish Facilities



Area of circles proportional to number of fish

Source:
BDAT Database
Monthly medians, 1993 - 2004

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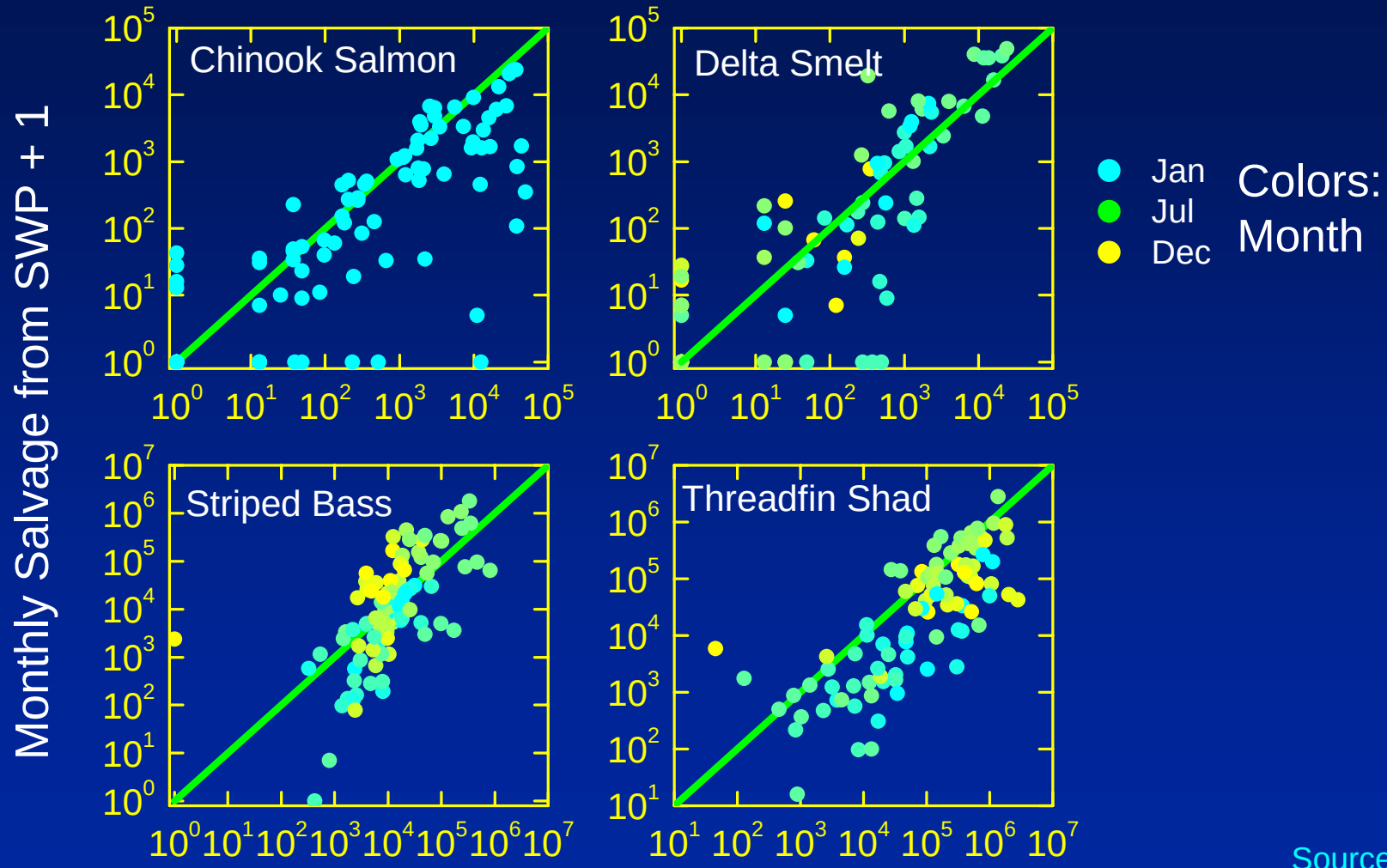
Abundance of Common Fish from the Fish Facilities

How do you expect the abundances to compare?

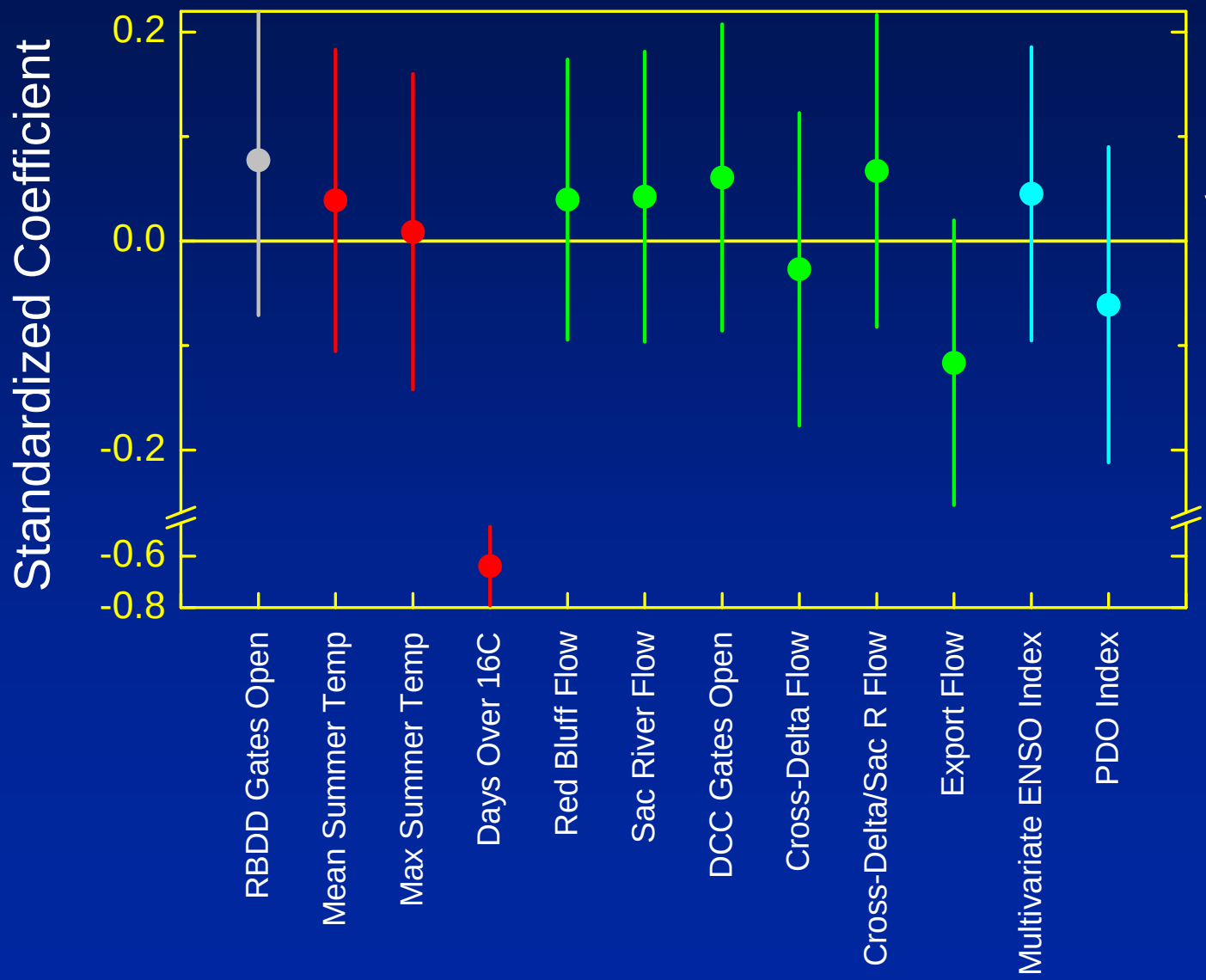
- Higher predation in front of SWP
  - More fish eaten?
- Louver efficiencies vary differently by size?
  - Smaller fish get through CVP screens?
- Source populations differ?
  - Salmon from upstream,
    delta smelt from downstream?

Abundance of Common Fish from the Fish Facilities



Source:
DFG Database
Monthly totals, 1997 - 2004

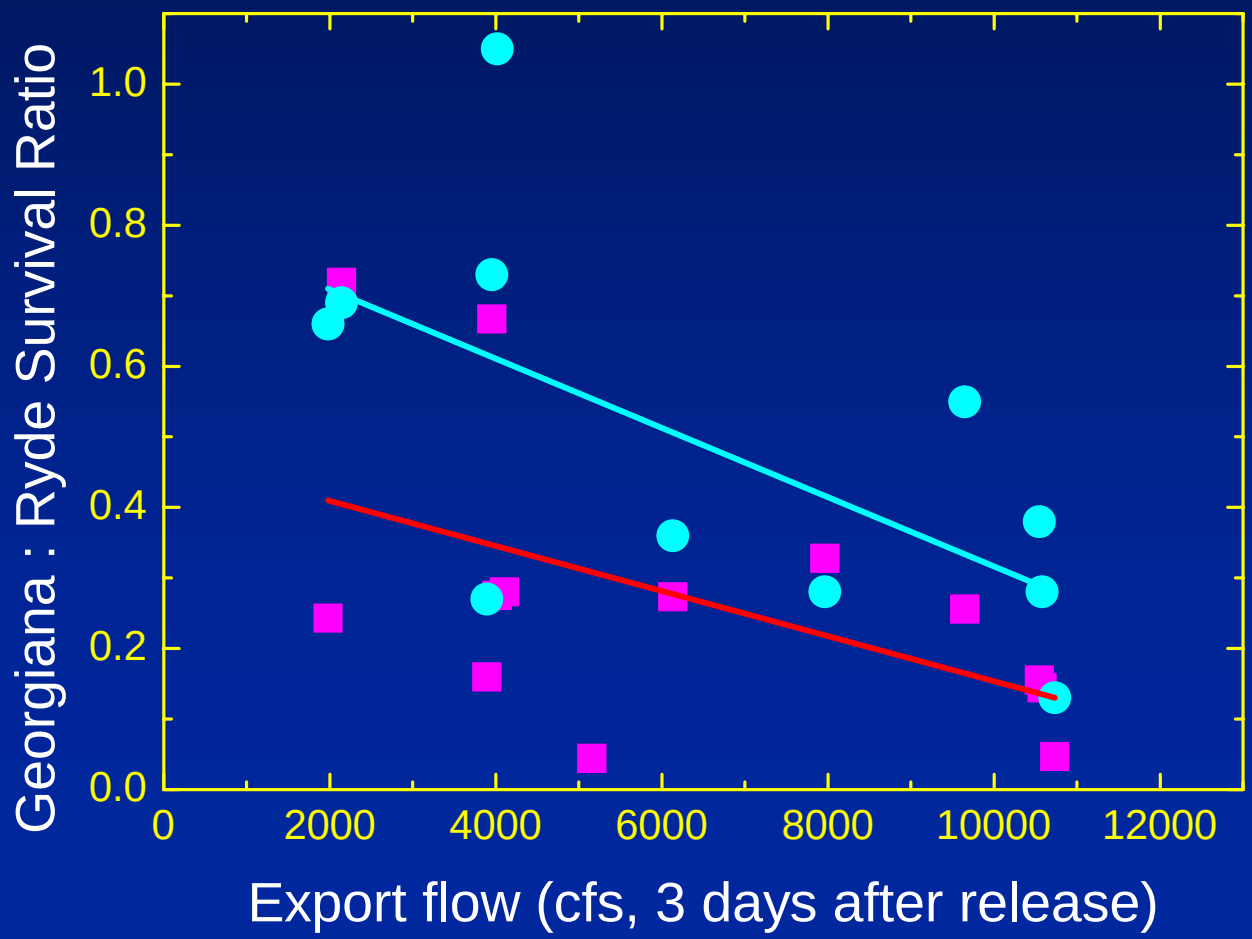
Model of winter run escapement: Residual analysis



Other environmental variables have no apparent effect:

Coefficients with 90% Confidence limits

Juvenile Survival Ratio in the Delta



Ratio of survival index through interior delta: survival index in mainstem Sacramento River

Source:
P. Brandes, USFWS
Dayflow

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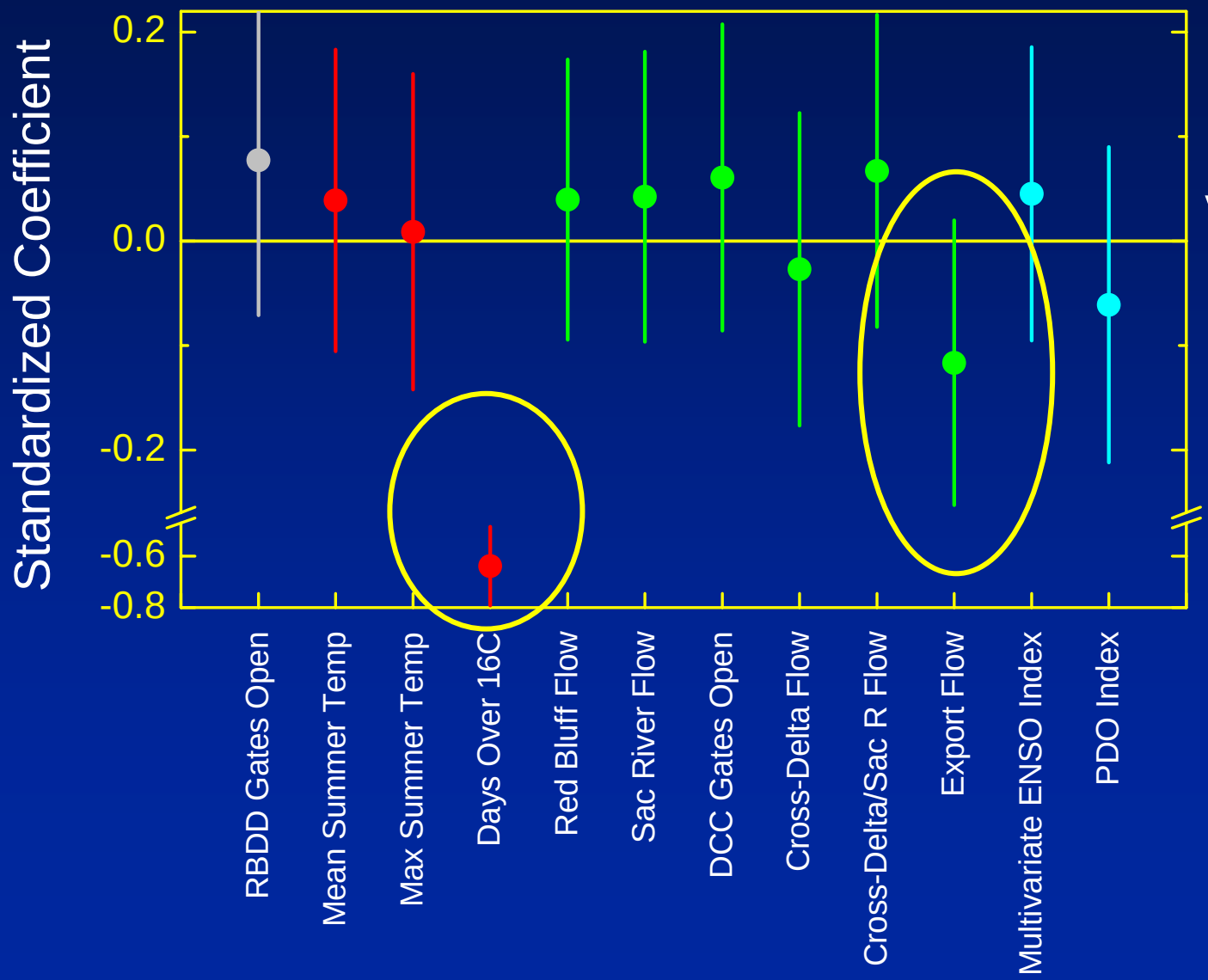

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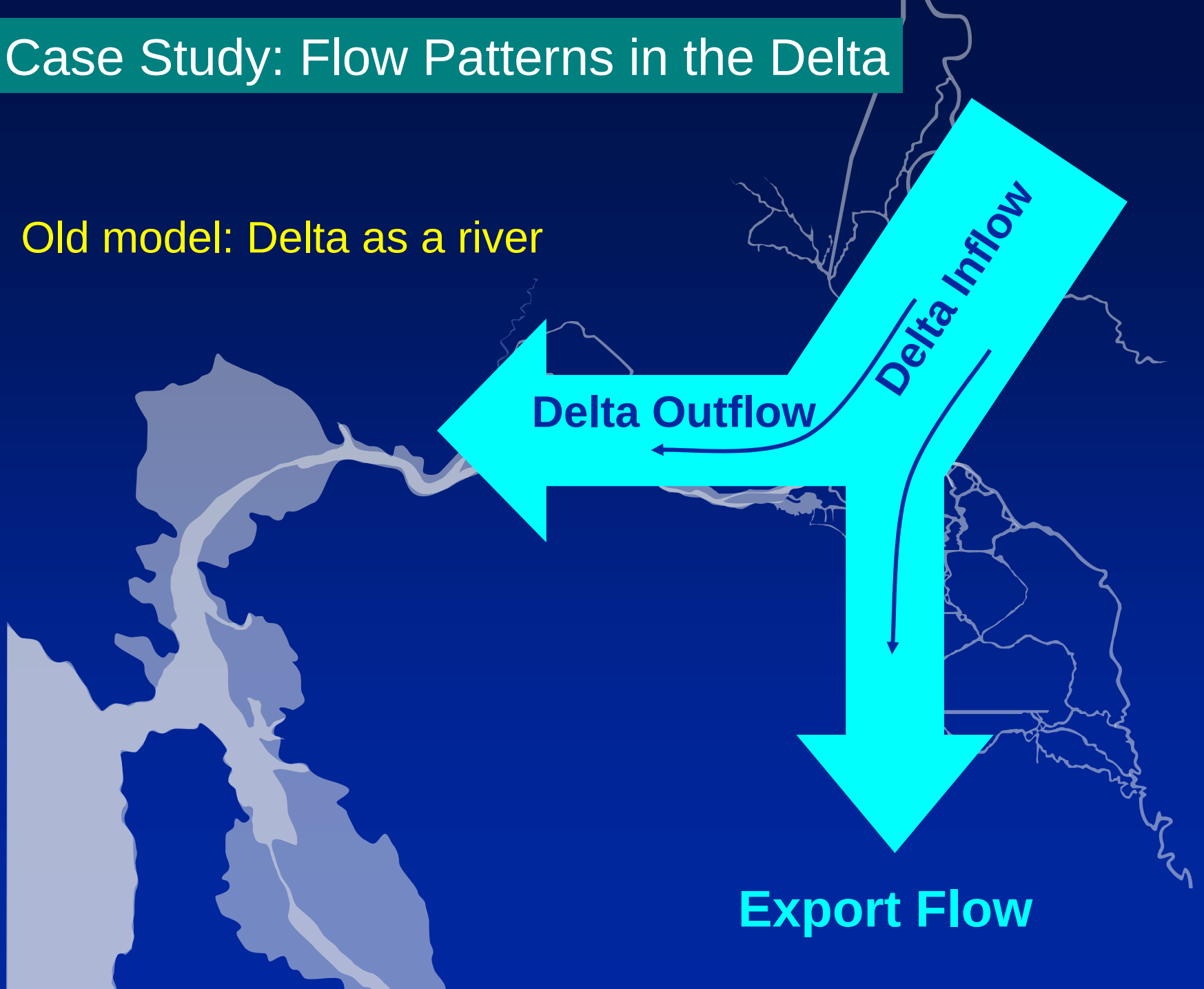
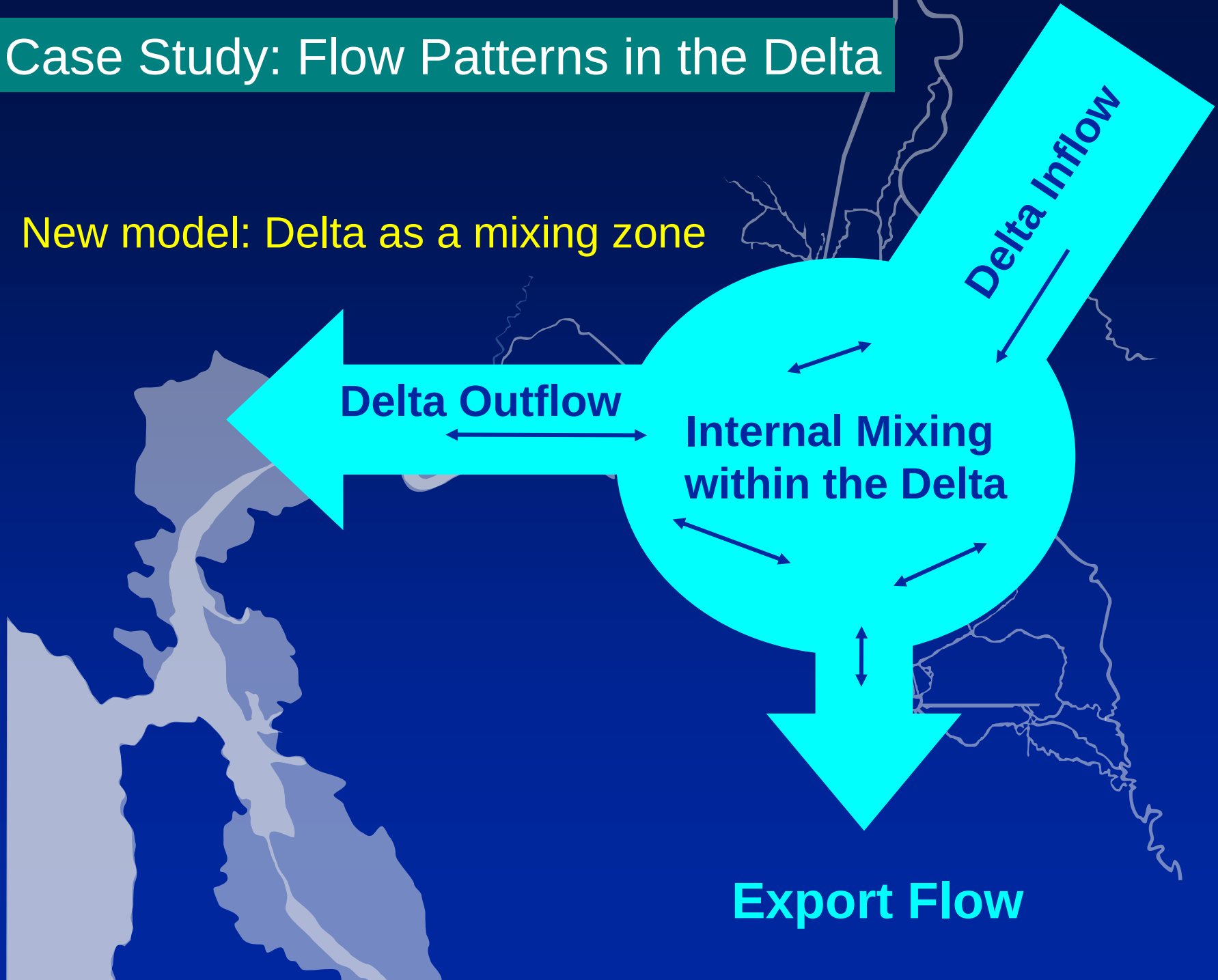
Case Study: Flow Patterns in the Delta

Old model: Delta as a river

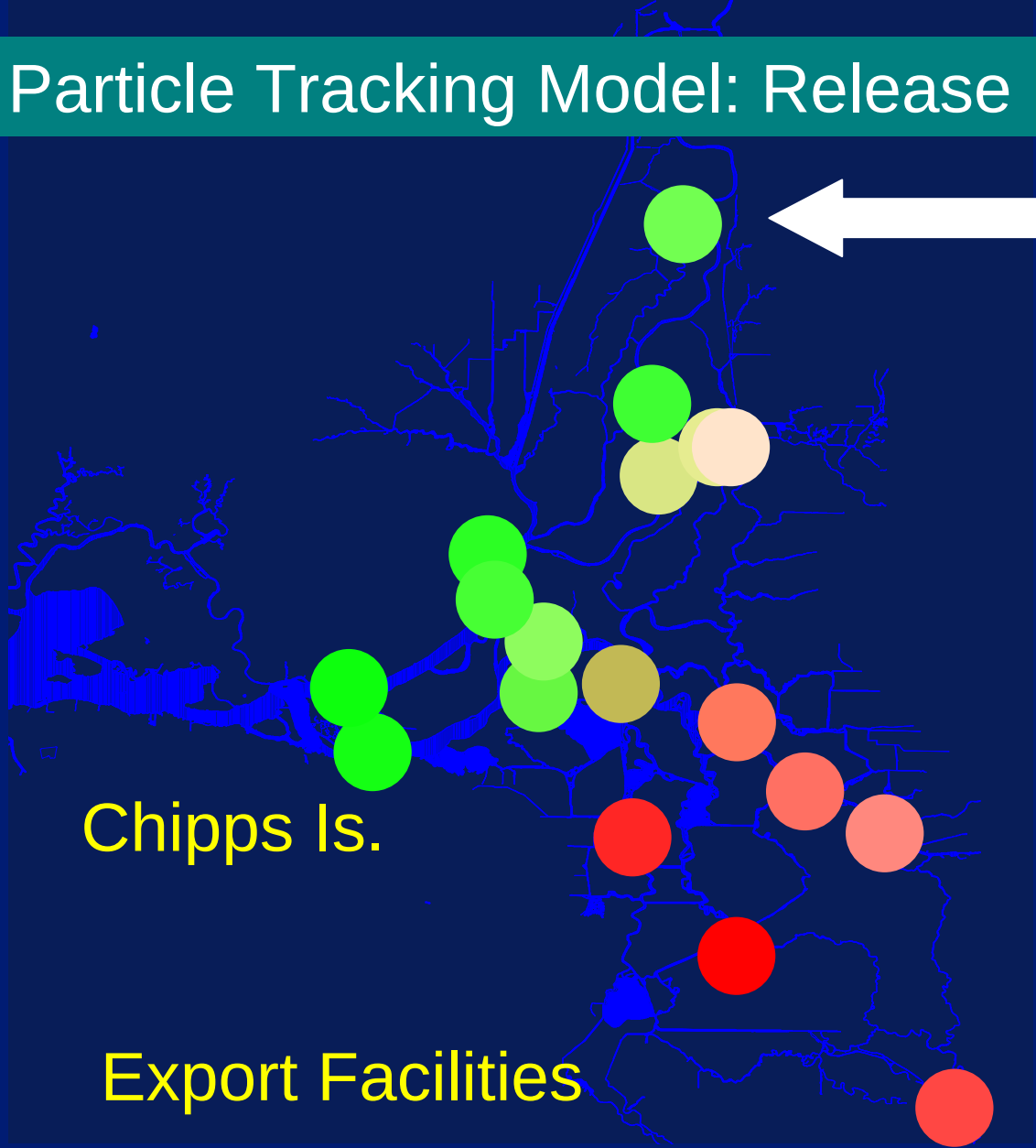


Case Study: Flow Patterns in the Delta

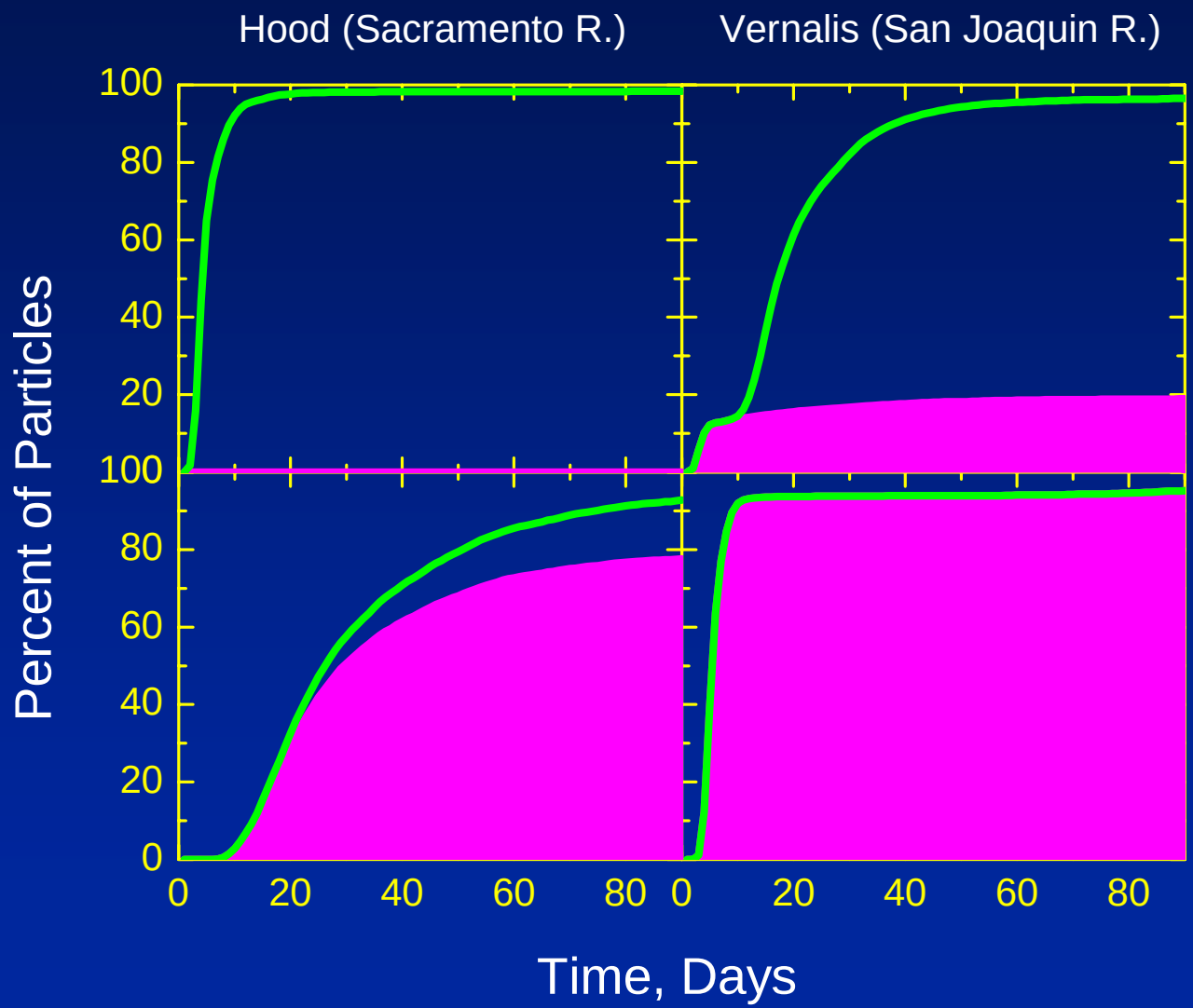
New model: Delta as a mixing zone



DSM-2 Particle Tracking Model: Release Points



Particle Tracking Model Examples



Q = 67,000 cfs
Ex = 2,000 cfs

Q = 12,000 cfs
Ex = 10,000 cfs

Summary and conclusions

- **The fundamental problem has a lot of moving parts**
- **Predation is only one of those parts**
- **No clear evidence yet of:**
  - **Predatory impact**
  - **Export impact**
- **Important to distinguish:**
  - **Effect of predation on loss estimates**
  - **Effect of predation on population abundance**
  - **Ecological implications of predation**

And thanks to my lab team:

- **Allegra Briggs**
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